# Parkinsoniids and garantianids (Late Bajocian Ammonoidea) as guide fossils and biostratigraphic indices

GIULIO PAVIA[1] * & SIXTO R. FERNANDEZ-LOPEZ[2]

[1]*Dipartimento di Scienze della Terra, Università degli Studi di Torino, 10125 Torino, Italy; E-mail: giulio.pavia@unito.it*
[2]*Departamento Paleontología, Facultad Ciencias Geológicas, calle José Antonio Novais,2, Universidad Complutense de Madrid, 28040-Madrid, Spain; E-mail: sixto@ucm.es*

Taphonomic, palaeobiological and biochronological data are relevant in interpreting time-space relationships of fossiliferous rock bodies, and in understanding the palaeoenvironmental changes taking place on Earth' surface. It is assumed that the bed-by-bed order of succession shown by fossils in the stratigraphic record represents the chronological order of the producer taxa. However, a particular feature of the fossil record can condition the validity of the palaeontological interpretations. In diverse cases it cannot be assured that fossils and rocks of the same stratigraphic interval represent the same time interval or the same palaeoenvironment. In this sense, it must be stressed that the fossil record can supply information on palaeoenvironments and processes that have left no traces in the stratigraphic record (FERNANDEZ-LOPEZ 2000). Consequently, palaeontological successions can display higher biochronological and geochronological completeness than lithostratigraphic and biostratigraphic successions. Taphonomic analyses are fundamental, as their results can furnish evidence of diachroneity within the facies and the fossil assemblages of the studied stratigraphic unit. The characterization of palaeontological units (such as the taphorecords) in a stratigraphic succession and their arrangement according to the time interval of the palaeobiological entities, which produced the recorded fossils, allow defining the palaeontological successions. The palaeontological succession can show a higher number of palaeoenvironmental, depositional, and palaeobiological events than the stratigraphic succession (PAVIA & MARTIRE 1997; PAVIA et al. 2013).

Also the palaeobiogeographic constrains have an effect on the potential of biochronostratigraphic interpretations: appearances of innovative biota in several areas (then fossils in the stratigraphic record) may be interpreted as synchronous events if they are the effects of synchronous geographic dispersions from a common external source area. However, they are diachronous towards the source area. The appearances of innovative biota can be complementarily calibrated through the synchroneity of the transgressive/regressive changes analysed in sequence stratigraphy, too (SANDOVAL et al. 2001).

Since the latest decades of the past century, the International Subcommission on Jurassic Stratigraphy (ISJS) promoted activities to get definitions for the Global Boundary Stratotype Section and Point (GSSP) of each stage of the Jurassic System, and more recently (MORTON 2003) asserted the opportunity to locate sections that could be proposed as reference for the basal boundary of substages. The definition of the base of each chronozone is also an aspect to be pursued. Such formal definitions are feasible where successions display high chronostratigraphic completeness and stratigraphic parameters do permit this (FERNANDEZ-LOPEZ et al. 2009; PAVIA & ZUNINO 2012). It becomes hard if the succession is affected by stratigraphic and/or taphonomic condensation (FERNANDEZ-LOPEZ 2011). That is a common case in the Parkinsoni Zone, which represents the latest Chron of the Bajocian Stage. The ammonite groups involved in the topic are basically: the microconch *Parkinsonia* with the macroconch partner *Durotrigensia*, and the macroconch *Garantiana* with many allied taxa among them the microconch *Pseudogarantiana*.

*Parkinsonia* l.s. - The first occurrence of parkinsoniids in the West Tethyan areas looks as sudden, and it is the diagnostic criterion to define the base of the Parkinsoni Zone (RIOULT

et al. 1997) according to the record of the group of *Parkinsonia acris* as the index of the basal subzone. Citations of "parkinsoniids" recur in the literature (e.g., SCHWEIGERT et al. 2002) but their meaning need to be clarified for effective taxonomic relationships and biostratigraphic pertinence, as they commonly derive from condensed stratigraphic sections affected by taphonomic condensation with re-elaborated fossils. Personal data from the Basque-Cantabrian Basin assure the presence of re-sedimented specimens (contemporaneous to the encasing sediments) in the middle part of the Garantiana Zone (FERNANDEZ-LOPEZ 1988). Such specimens show intermediate morphological features between the genus *Caumontisphinctes* of the uppermost Niortense Zone, and the *Parkinsonia* of the basal Parkinsoni Zone. This new biochronostratigraphic information means that the origin of *Parkinsonia* has to be found in a still unknown place within the Submediterranean Province, and that the first occurrence of *Parkinsonia* is not a valid criterion to recognize the basal boundary of the Acris Subzone as it may be affected by diachroneity in terms of palaeobiogeographic gradients between the Submediterranean and NW European provinces. New continuous biostratigraphic and palaeontological successions are needed to define the subzonal and zonal Garantiana-Parkinsoni boundary.

*Garantiana* l.s. – This early and middle Late Bajocian taxon developed in the Submediterranean Province and repeatedly diversified during the Garantiana Chron with largest dispersion in the NW European Province. Taxa of the dimorphic couple *Garantiana–Pseudogarantiana* are zonal and subzonal indexes for the Garantiana Zone throughout most of the Mediterranean-Caucasian Subrealm. Garantianids developed through evolutionary lineages according to palingenetic processes and peramorphic modifications, interrupted by paedomorphic changes. This iterative evolutionary pattern produced numerous and brief phyletic lineages with common homeomorphs that make it difficult to unravel their taxonomic "strapwork". Moreover, the type specimens of most garantianids were elected on fossils deriving from the condensed sections of the NW European Province (e.g., DIETZE et al. 2002,

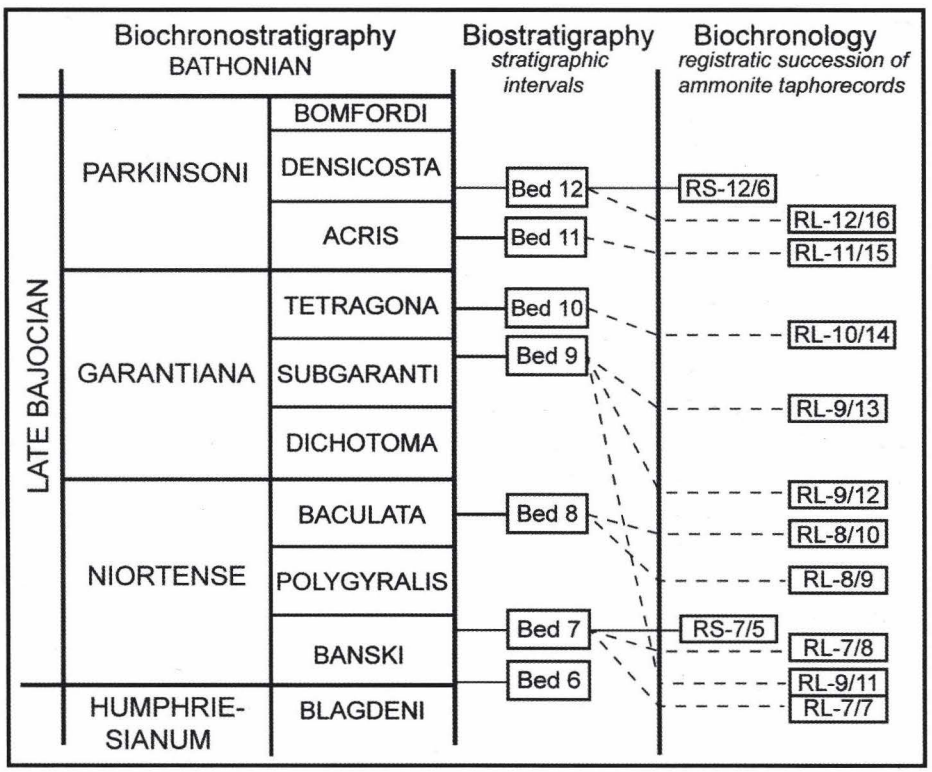


**Fig. 1.** The biochronological and palaeontologic succession of the Upper Bajocian of Maizet. The left column lists the geochronological divisions and the standard (sub)chronozones for the Bajocian Stage of the West Tethyan Subrealm (modified from PAVIA et al. 2013: fig. 7).

and references therein). Only the latest genus *Paragarantiana* is unambiguously recorded, as contemporaneous with the sedimentary rock bodies, from the lowermost Parkinsoni Zone

*Paragarantiana* is largely documented in the central sector of the Jurassic Anglo-Paris Basin, and on it we concentrated our research. Although the Bajocian sections of Calvados are condensed, repeated taphonomic analyses (PAVIA et al. 2013, and references therein) allowed aligning successive palaeontological units with biochronological meaning (Fig. 1). Our study delineates the following conclusions: (1) *Paragarantiana* derived by a proterogenetic process with paedomorphic result from garantianids, during the transition between the Garantiana and Parkinsoni zones, displaying the first occurrence in layers of the first record of *Parkinsonia* gr. *acris*; (2) such a new phyletic lineage seems to be driven by a sea-level change at the passage between the Garantiana and Parkinsoni biochrons; (3) this evolutionary event of *Paragarantiana* origination has an unequivocal and singular biochronological meaning that may be used to define the base of the Parkinsoni Zone, possibly paired with the first appearance of the *P. acris* group when its chronostratigraphic value would be ascertained.

The research was supported by the University of Torino grants (2009) and the scientific project CGL2011-23947 (MICINN).

**References**

DIETZE, V., SCHWEIGERT, G., CALLOMON, J.H. & GAUTHIER, H. 2002. Garantiana- und frühe Parkinsoni-Zone (Ober-Bajocium, Mittlerer Jura) am Ipf (östliche Schwäbische Alb, SW-Deutschland) mit Bemerkungen zur Phylogenie der Ammonitengattung *Garantiana* Mascke, 1907. – Stuttgarter Beiträge zur Naturkunde B 315: 1–89.

FERNANDEZ-LOPEZ, S. 1988. El Bajociense superior y Bathoniense inferior en Mataporquera (Santander). Ciencias de la Tierra. – Geología 11: 73–84.

FERNANDEZ-LOPEZ, S. 2000. Ammonite taphocycles in carbonate epicontinental platforms. In: HALL, R.L. & SMITH, P.L. (eds.), Advances in Jurassic Research 2000. – GeoResearch Forum 6: 293–300.

FERNANDEZ-LOPEZ, S.R. 2011. Taphonomic analysis and sequence stratigraphy of the Albarracinites beds (lower Bajocian, Iberian Range, Spain). An example of shallow condensed section. – Bulletin de la Société Géologique de France 182: 405–415.

FERNANDEZ-LOPEZ, S.R., PAVIA, G., ERBA, E., GUIOMAR, M, HENRIQUES M.H., LANZA, R., MANGOLD, MORTON, N., OLIVERO, D. & TIRABOSCHI, D. 2009. Formal proposal for the Bathonian GSSP (Middle Jurassic) in the Ravin du Bès Section (Bas-Auran, SE France). – Swiss Journal of Geosciences 102: 271–295.

MORTON, N. 2003. Meeting of Jurassic Subcommission Mondello, Sicily. 19th September 2002. – International Subcommission on Jurassic Stratigraphy, Newsletter 30: 3–4.

PAVIA, G. & MARTIRE, L. 1997. The importance of taphonomic studies on biochronology: examples from the European Middle Jurassic. – Cuadernos de Geologia Iberica: 153–181

PAVIA, G. & ZUNINO, M. 2012. Ammonite assemblages and biostratigraphy at the Lower to Upper Bajocian boundary in the Digne area (SE France). Implications for the definition of the Late Bajocian GSSP. – Revue de Paléobiologie, vol. spéc. 11: 205–227.

PAVIA, G., DEFAVERI, A., MAERTEN, L., PAVIA, M. & ZUNINO, M. 2013. Ammonite taphonomy and stratigraphy of the Bajocian at Maizet, South of Caen (Calvados, NW France). – C.R. Palevol 12: 137–148.

RIOULT, M., CONTINI, D., ELMI, S. & GABILLY, J. 1997. Bajocien. In: CARIOU, E. & HANTZPERGUE, P. (eds.), Biostratigraphie du Jurassique ouest-européen et méditerranéen. – Bulletin du Centre des Recherches Exploration-Production Elf-Aquitaine, Mémoire 17: 41–53.

SANDOVAL, J. L., O'DOGHERTY, L. & GUEX, J. 2001. Evolutionary rates of Jurassic ammonites in relation to sea-level fluctuations. – Palaios 16: 330–363.

SCHWEIGERT, G., DIETZE, W. & DIETL, G. 2002. Erstnachweis der Ammoniten-Gattung *Parkinsonia* BAYLE, 1878 in der Garantiana-Zone (Tetragona Subzone). – Stuttgarter Beiträge zur Naturkunde B 320: 1–15.

# 9th International Congress on the Jurassic System, Jaipur, India

—

# Abstracts

D. K. Pandey, F. T. Fürsich & M. Alberti (Eds.)


**Beringeria** Special Issue 8 - Erlangen 2014

**Cover photographs**
*Front:* The facade of the Hawa Mahal or Palace of Winds in Jaipur.
*Back:* A mural in the Nahargarh Fort near Jaipur.

---

**Addresses of the editors:**
DHIRENDRA K. PANDEY, Department of Geology, University of Rajasthan, Jaipur, 302004, India; E-mail: dhirendrap@hotmail.com
FRANZ T. FÜRSICH, GeoZentrum Nordbayern, Fachgruppe Paläoumwelt der Friedrich-Alexander-Universität Erlangen-Nürnberg, Loewenichstr. 28, D-91054 Erlangen, Germany; E-mail: franz.fuersich@fau.de
MATTHIAS ALBERTI, Institut für Geowissenschaften, Christian-Albrechts-Universität zu Kiel, Ludewig-Meyn-Str. 10, D-24118 Kiel, Germany; E-mail: alberti@gpi.uni-kiel.de

---

Beringeria, **Special Issue 8**: 213 pages
Erlangen, 01.12.2013
**ISSN 0937-0242**

Publisher:
Freunde der nordbayerischen Geowissenschaften e.V.

Editorial Office:
GeoZentrum Nordbayern, Fachgruppe Paläoumwelt,
Friedrich-Alexander-Universität Erlangen-Nürnberg
Loewenichstr. 28, D-91054 Erlangen, Germany.

Print:
Tiwari Printers
Jhotwara, Jaipur, 302012, India.